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DESCRIPTIONS OF NEW STAPHYLINIDAE (COLEOPTERA)[1]

By Malcolm Cameron, M.B., R.N., F.R.E.S.

Conosoma nigerrimum sp. n.

Shining, black, the posterior margins of the thorax and tergites narrowly rufescent. Antennae yellow, the 3rd to 10th segments infuscate. Legs reddish-yellow. Length 5 mm. (abdomen extended).

Of exactly the same build and antennal structure of *ceylanense* Kr., the fore-parts scarcely differing in puncturation and pubescence, but at once distinguished by the much more densely punctured and pubescent abdomen and shorter setae. The colour of the whole insect also is distinctly blacker.

United Provinces. Dehra Dun. Unique. My collection.

Tachinus limbicollis sp. n.

Rather shining, black, the anterior and posterior margins of the thorax narrowly, the lateral margins more broadly yellow especially behind; elytra with a small oval yellow spot at the shoulders, the posterior margin very narrowly and obscurely yellow, the posterior margins of the tergites very narrowly and obscurely yellowish. Antennae black, the first two segments reddish-yellow. Legs reddish-yellow, the tibiae slightly infuscate. Length 5·5 mm.

Build and antennal structure of *piceus* Cam. but blacker, the yellow markings more sharply defined, that of the lateral margin of the thorax narrower in front, the ground sculpture of the head and thorax quite different, transverse and wavy and with distinct though small and scattered punctures; the sculpture of the elytra scarcely differs in the two species, but the abdomen is much more closely punctured and the ground sculpture stronger.

Darjeeling: Ghum district: Mangpu. A single specimen in my collection.

Tachinus ornatus sp. n.

Shining black, the anterior and posterior margins of the thorax narrowly, the sides broadly (especially behind) yellow; the elytra with a large yellow marking on each disc and the posterior margin narrowly yellow; abdomen with the posterior margins of the tergites yellow. Antennae black, the 1st segment yellow, the 2nd brownish-yellow. Legs yellow. Length 4·75 mm.

Build of *himalayicus* Cam. but differently coloured, the antennae longer and more slender, the head and thorax more punctured. Head very finely, moderately closely punctured. Antennae with the 3rd segment a little longer than the 2nd, 4th to 7th longer than broad, decreasing in length, 8th to 10th about as long as broad. Thorax transverse (4·3 : 2·75), the sides rounded and more retracted towards the front, finely and closely punctured. Elytra longer (4·5 : 2·75) and broader than the thorax, slightly broader than long, the puncturation very similar. Abdomen narrowed towards the apex, closely and finely punctured.

♂. 8th tergite with four stout triangular processes, the median pair longer than the lateral and separated from each other by an acute excision, the apex of each with three short setae, the lateral each with a longer black seta: 5th sternite with broad parallel-sided excision in the middle, at its anterior border with a semilunar impression, its fundus granular; the truncate posterior margin of the segment on each side of the excision with five

[1] Continued from 1944, *Proc. R. ent. Soc. Lond.* (B) **13**: 15.

rather long, closely placed, equal yellow spines, the adjacent surface granular and externally with a long black seta: 6th with four processes each with a long black seta at the apex, the lateral acute, short, the median pair longer and broader, separated from each other by an acute triangular excision.

DARJEELING: Ghum district: Tiger Hill, altitude 8500–10,000 feet. Type in my collection.

Hypocyptus championi sp. n.

Shining, head, thorax and elytra reddish-yellow, abdomen pitchy black, the last two segments reddish-yellow. Antennae and legs reddish-yellow. Length 1 mm.

Size and build and with the antennal structure of *indicus* Cam. but of different colour and shorter elytra, the thorax a little less closely punctured and without ground sculpture; elytra shorter, more transverse (5 : 3), extremely finely and much less closely punctured, the ground sculpture scarcely visible; abdomen extremely finely punctured, the ground sculpture extremely fine, reticulate.

UNITED PROVINCES: Nainital: altitude 7000–8600 feet, vii.1923 (*H. G. Champion*). Type in British Museum (Natural History).

Hypocyptus indicus sp. n.

Shining, black, the lateral margins of the thorax narrowly yellowish (by translucency), the posterior margins of the 5th and 6th visible tergites sometimes reddish. Antennae and legs reddish-yellow. Length 1 mm.

In build, colour and with the antennal structure of *laeviusculus* Mannerh. but with the punctures of the thorax not quite so close and the ground sculpture much less evident, scarcely visible, the puncturation of the elytra much stronger but less close than in that species, more shining, the ground sculpture also less distinct; puncturation of abdomen not quite so fine, ground sculpture scarcely visible. The pubescence throughout longer and coarser.

KUMAON: Dudhatali, altitude 8000–10,000 feet (*H. G. Champion*). Type in British Museum (Natural History).

Paracyptus gen. n.

Build of *Hypocyptus* Mannerh. but at once distinguished from all the Hypocyptini by the very long and slender 4th segment of the maxillary palpi. These are long, the 2nd and 3rd segments elongate, of equal length, the 4th very long and slender, distinctly longer than the 3rd and acutely pointed. Tarsi 4-segmented. Owing to lack of material for dissection further details are not available.

Type of the genus, the following species.

Paracyptus glaberrimus sp. n.

Very convex, ovate shining, dark ferruginous red (almost black), the abdomen with the posterior margins of the last two segments narrowly and obscurely reddish-yellow. Antennae and legs reddish-yellow. Length 0·75 mm.

In build much like *Hypocyptus seminulum* Er. but the antennae more slender and the whole insect without sculpture and except for a few fine hairs at the sides of the abdomen devoid of pubescence. Antennae with the first two segments stout, the 2nd twice as long as the 1st, 3rd to 7th slender, each a little longer than broad but decreasing in length, the 7th only slightly longer than broad, 8th to 10th much stouter, forming a club, 8th and 9th a little longer than broad, the 9th stouter than the 8th, 10th not quite so long as the 8th and

9th together. Thorax transverse (4·5 : 3), the sides rounded, retracted in front, the posterior angles and base rounded. Elytra as long as, and slightly broader than the thorax, transverse (5 : 3), the sides and posterior angles rounded. Abdomen narrowed from base to apex, the sides narrowly margined.

DARJEELING : Ghum district. Unique. Type in my collection.

Myllaena kashmirica sp. n.

Myllaena infuscata Cam., 1939, *Faun. Brit. Ind.* **1** (4) : 20 (*nec* Kr.).

This species is distinct from *infuscata* Kr. in the following respects : of larger size and more robust build, slightly larger than *minuta* Kr., from which it differs in the blacker colour, longer, stouter antennae, the penultimate segments distinctly longer, the thorax with the puncturation not so close and not at all granular, the elytra distinctly less finely punctured, the abdomen less finely and less densely punctured, the pubescence coarser than in either of the above-mentioned species. From *intermedia* Er. it differs in the smaller size, narrower build, shorter thorax, shorter, stouter antennae, the penultimate segments distinctly shorter, shorter less finely punctured elytra, less densely punctured and pubescent abdomen.

Type in my collection.

Placusa (s.str.) **rufoflava** sp. n.

Moderately shining, the head dark reddish-brown, thorax and abdomen reddish-yellow, the bases of the 4th and 5th visible tergites infuscate, elytra brownish-yellow. Antennae reddish-yellow, the penultimate segments slightly infuscate. Legs reddish-yellow. Length 1·75 mm.

A small brightly coloured species of the size and build of *pygmaea* Kr. but differing in the colour, stouter antennae, more finely and less closely punctured head, thorax and abdomen, the elytra, however, scarcely differing from that species in sculpture. Penultimate segments of antennae about three times broader than long, the 11th distinctly longer than in *pygmaea*; ground sculpture of fore-parts absent, that of the abdomen reticulate, finer than in that species. The specimens before me show no sexual characters.

CENTRAL PROVINCES, iv.1923. Type in my collection.

Falagria (Stenagria) chakratana sp. n.

Head and thorax black, greasy lustrous, elytra and abdomen shining, the former dark brown with the base reddish-yellow, the latter black with the first visible tergite yellow. Antennae blackish, the first two segments reddish-yellow. Legs reddish-yellow, the femora and tibiae more or less infuscate. Length 4 mm.

Size and build of *longiceps* Cam. but with differently coloured and slightly longer antennae, the penultimate segments longer, the sculpture of the head of similar character but a little coarser, the lustre similar; thorax more shining, the sculpture much weaker than in *longiceps*, finely coriaceous; elytra with fine and sparing puncturation, not quite so fine as in that species; abdomen very finely and very sparingly punctured on the first three visible tergites, much more closely on the 4th and 5th; ground sculpture absent.

CHAKRATA DISTRICT : Khedar Khud, altitude 7500 feet. Type in my collection.

Falagria (Stenagria) semipolita sp. n.

Head and thorax greasy lustrous, black; elytra and abdomen shining, the former brownish-yellow, sometimes slightly infuscate about the scutellum, the latter black with

the posterior margins of the tergites narrowly rufescent. Antennae dark reddish-brown, the first two segments lighter. Legs yellowish-red, the femora slightly infuscate. Length 4·5 mm.

Near *longiceps* Cam. Very similar in colour and lustre, but with broader less pear-shaped head and broader thorax, the elytra yet more finely punctured. Head slightly longer than broad, suborbicular, impressed between the antennae, strongly coriaceous and impunctate. Antennae long, all the segments distinctly longer than broad, the penultimate about twice as long as broad. Thorax longer than broad (5 : 4), narrowly sulcate along the middle, closely covered with small granules, impunctate. Elytra as long as but broader than the thorax, extremely finely, rather closely punctured, the ground sculpture scarcely visible. Abdomen finely and rather closely punctured and with very fine ground sculpture.

Chakrata district: Dodora Khud, Chulli Khud, Binal Gad, altitude 7000–8000 feet. Type in my collection.

Falagria (Anaulacaspis) almorensis sp. n.

Shining, head and thorax dark reddish-brown; elytra brownish-yellow, broadly infuscate across the middle; abdomen black, the posterior margin of the first visible tergite broadly, the following more narrowly reddish-yellow. Antennae black, the 1st, 2nd and 10th and 11th segments reddish. Legs reddish-yellow. Length 3 mm.

Somewhat resembling *subrugosa* Kr. in build, but of darker colour, the antennae similarly constructed, but with the head less transverse, rounder, the eyes much smaller, the punctuation of the head and thorax less fine and closer, elytra very finely, moderately closely and uniformly punctured throughout, abdomen much more closely punctured. The whole insect without ground sculpture.

W. Almora: Dhauli Ganga. Type in my collection.

Myrmecopora (Ilyusa) elegans sp. n.

Shining; head ferruginous red, thorax and elytra bright reddish-yellow, the latter with the scutellary region infuscate and a large indeterminate fuscous marking extending from the reflexed margin nearly to the suture; abdomen with the first two visible tergites, the posterior margin of the 5th and whole of the 6th reddish-yellow. Antennae reddish, the first four or five segments and legs reddish-yellow. Length 2·3 mm.

Build of *fugax* Er. but much smaller and differently coloured. Head transverse, subquadrate, as broad as the thorax, the posterior angles rounded, the disc finely, moderately closely punctured, the base and front practically impunctate; ground sculpture absent. Antennae with the 3rd segment a little shorter than the 2nd, 4th a little longer than broad, 5th to 10th gradually more transverse, the penultimate segments fully a half broader than long. Thorax scarcely transverse, the sides rounded in front, distinctly retracted behind, before the scutellum with a small impression or with the posterior two-thirds of the disc superficially impressed (♂?), on the disc punctured like the head, elsewhere nearly impunctate and without ground sculpture. Elytra a good deal broader and a little longer than the thorax, broader than long, more finely, moderately closely punctured. Abdomen narrowed towards the apex, very finely moderately closely punctured and without ground sculpture.

Punjab: Lyallpur. Under dead leaves on moist soil (*Ghani*). Type in British Museum (Nat. Hist.).

ON EROTYLID BEETLES BELONGING TO *SPONDOTRIPLAX* AND SOME ALLIED GENERA, WITH DESCRIPTIONS OF A FEW NEW SPECIES (COLEOPTERA)

By Gilbert J. Arrow, F.Z.S., F.R.E.S.

British Museum (Natural History).

The genus *Spondotriplax* Crotch, which contains numerous species of small beetles in India and the Malayan and Papuan Regions, illustrates in a striking manner the association between geographical distribution and coloration. All species from the Indo-malayan Region at present known exhibit patterns of strongly contrasted black and red or yellow, often almost identical with those found in beetles from the same region belonging to another subfamily, the Dacninae. Similar patterns are unknown in any species of the genus from the Papuan Region. In these the head, legs and lower surface are commonly pale, in strong contrast with the dark elytra, while the anterior and posterior halves of the body may be light and dark respectively. Blue or metallic colours in the Papuan species generally replace the black ground colour of most Indo-malayan representatives. These colour characteristics are shared with many little beetles of different genera found in the same region, *e.g.* Coccinellidae and Halticidae.

The structural differences between the species of *Spondotriplax* are very slight indeed. Dr. Heller (1920, *Archiv f. Nat.* **84**, A8 : 28) has proposed a new genus, *Neotritoma*, to which all but the type-species of *Spondotriplax* (*quadrimaculata* Kirsch = *endomychoides* Crotch) are to be transferred on account of the greater width of the last joint of the maxillary palpi in that species but, in view of the varying proportions of the joint, this seems to me quite unnecessary. Another genus, *Rhopalotritoma* Heller, although not associated by its author with *Spondotriplax*, appears to me to be hardly separable and I have provisionally included the only species (*amabilis* Heller) in the table which follows. The 5-jointed antennal club, as figured and described, certainly points to this rather than to its association with *Cyrtomorphoides*, as preferred by Dr. Heller, and the figure shows an insect almost identical in pattern with *S. diaperina* Gorham.

Dr. Heller has called the club of the antenna of *Rhopalotritoma* 5-jointed and that of *Spondotriplax* 4-jointed, but, as the 7th joint is distinctly transverse in all cases, I can find no reason for such a distinction and regard the club as a 5-jointed one.

S. reibenspiesi Mader I believe to be identical with *S. cyanecula* Crotch and, after examination of fairly numerous specimens, I consider the Bornean *S. propinqua* Arrow best treated as a variety of the Sumatran *S. exquisita* Arrow. Two species recently ascribed to the genus, viz., *S. jucunda* Mader and *S. flavofasciata* Araki, are unknown to me, as is *Neotritoma monticola* Heller, but the characters described and figured appearing sufficient to assign their correct position in the table of species at the end of this paper, I have ventured to include in it the first and third of these.

The genus *Hedista* Weise (1926, *Ark. Zool.* **18**, no. 34 : 33), formed for *H.*

tricolor Weise from North Queensland, is also unknown to me, but it is evidently nearly related to *Spondotriplax* and very likely inseparable from it.

The genus *Camptotritoma* Heller differs from *Spondotriplax* Crotch more obviously in the broadly dilated tibiae than in the union in front of the elevated prosternal lines, which form a triangle. The latter distinction, the only one mentioned by Dr. Heller, is incorrectly represented in his illustrative diagram, in which these lines do not, as stated, extend past the middle. It seems possible that this structure of the prosternum may be attained independently in species not closely related and is therefore not a truly generic feature. An almost similar structure is found in *Spondotriplax metallica*, although in other respects it seems to have little resemblance to *Camptotritoma fulva* Heller. A second species of *Camptotritoma* is now described.

The new genus *Helcocerus*, described here, is not very closely related to any other at present known, although belonging to this group of genera.

Helcocerus gen. n.

Elongate-oval, very convex, with short antennae and legs. Eyes not very small, finely faceted. Antennae stout and compact, joint 1 large, almost globular, 2 globular, 3 about twice as long as broad, 4–8 short and very closely articulated, forming an arc, 9–11 very broadly transverse. Maxillary palpi with the terminal joint twice as broad as long. Mentum with acutely triangular anterior process, the labial palpi very short, the last joint rather large, oval.

Pronotum with short basal lobe, scutellum small, about as long as broad, the apex sharp. Prosternum excavated on each side and compressed in front to form a short, stout anterior process, the tangential lines long and almost meeting in front; mesosternum with a semicircular raised line; metasternal lines reaching the episterna and abdominal lines almost reaching the base of the first ventral sternite.

Tibiae triangular, very broad at the end; tarsi short, broad and hairy beneath.

Genotype the following species :—

Helcocerus saundersi sp. n.

Brownish-black above, with the head, antennae, legs and lower surface ferruginous.

Head finely punctured in front, almost smooth behind. Pronotum very finely and sparsely punctured, a little more strongly at the sides, with the lateral margins gently rounded, the front angles not very sharp, the hind angles very obtuse, the base broadly lobed in the middle with a row of elongate marginal punctures on each side. Elytra with a juxta-sutural stria upon the posterior half and six longitudinal rows of rather strong punctures, the first row feebler than the rest and the 6th abbreviated in front and behind. Prosternum almost smooth, metasternum and abdomen minutely and not closely punctured.

Length 3–3·5 mm.

Malay Peninsula : Singapore (*C. J. Saunders*, July).

Five specimens were found in fungi.

The very peculiar antennae will enable this genus to be identified at once. They are very short and stout, with the 3rd joint alone distinctly elongate, the 4th to 11th transverse and the last three forming a broad club. The 4th and following joints are not in line with the preceding three. Joints 4 to 8 have little or no power of separate movement, being closely connected together and attached to the 3rd not at its extremity but a little to the side, making together a nearly semicircular arc. The last three joints form a broad club.

Another feature separating the genus from the rest of the Tritomini is the production of the prosternum in front to form a short and very stout process. The tibiae are strongly dilated at the end, the breadth of the two anterior pairs being nearly half their length. The hind tibiae are a little longer.

H. saundersi is dark above, with the head, the sides of the pronotum and the shoulders and apices of the elytra generally vaguely reddish. The upper surface is very smooth and shining, lightly punctured, except upon the elytra, which bear rather well-marked rows of punctures. The club of the antenna is clothed with pale hairs.

Camptotritoma papuana sp. n.

Greenish-black above, with the pronotum yellowish-brown, the legs and lower surface testaceous, the six basal joints of the antenna yellow and the last five joints greyish-black.

Oval, convex, very smooth and glossy, with the head finely and sparsely punctured and the pronotum very minutely, the sides of the latter feebly curved, the front angles rather and the hind angles very blunt, the scutellum short and broad, the elytra bearing seven longitudinal rows of small punctures, placed rather far apart and vanishing before the apex, the first row replaced behind the middle by a fine juxta-sutural stria. Lower surface very smooth, almost unpunctured, the prosternal triangle extending to a little behind the front margin, its apex semicircular; mesosternum with an incised arcuate line reaching to about the middle. Legs short, the tibiae broadly dilated at the apex. Antennae with the third joint almost as long as the three following and the last five forming a rather broad club, clothed with conspicuous yellow hair.

Length 3·5 mm.

Eastern New Guinea: Kokoda, 1200 ft. (*Miss L. E. Cheesman*, May).

A single specimen was found in a fungus.

Camptotritoma was characterised by Heller for two Philippine species to which the present one appears to be nearly related. It differs from the type-species, *C. fulva* Heller, in its dark feebly metallic greenish-black colour and very glossy surface above and beneath. The intervals between the rows of rather widely separated elytral punctures are hardly perceptibly punctured. In *C. fulva* the puncturation is no doubt of a kind intermediate between the "crebre" of the Latin diagnosis and the "zerstreut" of the German description. The head in *C. papuana* is very finely and sparsely punctured and the lower surface of the body is almost unpunctured. The breadth of the hind tibia at its extremity is nearly equal to one-third of its length.

Spondotriplax antennalis sp. n.

Black, with the elytra deep blue or purple, the abdomen and the tarsi and footstalk of the antennae reddish-testaceous, joints 7 and 8 of the latter black and the three terminal joints very pale yellow, the 9th joint generally dark at the base.

Broadly oval, very smooth and shining, the head not very closely nor very finely punctured, the pronotum bearing very fine scattered punctures, its sides almost straight, the front angles fairly sharp and hind angles blunt, the elytra bearing seven rows of fine inconspicuous punctures, the innermost row only present in front and all disappearing before the apex. The third joint of the antenna is almost as long as the following three together and the club is rather broad. The elevated lines of the prosternum are very short and far apart and the metasternum bears fine scattered punctures.

Length 3·5–4 mm.

Eastern New Guinea: Kokoda, 1200 ft. (*Miss L. E. Cheesman*, May; August). Mysol (*A. Russel Wallace*).

Several specimens were found by Miss Cheesman in fungi.

The species is similar in its form and coloration to *S. cyanecula* Crotch but differs conspicuously in its dark head and legs and especially in the extremely pale terminal part of the antenna, in which it is unlike any other known species. The colouring is rather variable. The head and pronotum may show a slight metallic lustre and the elytra vary from blue to nearly black. The colour of the legs is also rather inconstant. They are generally dark but the tarsi are pale and sometimes the tibiae also.

Spondotriplax metallica sp. n.

Testaceous-yellow, with the pronotum and elytra metallic greenish-black, the club of the antenna, except its tip, black and sometimes also the sides or the whole of the sternum.

Rather narrowly oval and very convex, with slender legs and antennae, the third joint of the latter nearly as long as the three following and the club not very broad. The head bears numerous not very fine punctures. The pronotum is more finely and rather less closely punctured, its sides are almost straight, the angles rather blunt and the angle-pores well marked. The elytra bear seven rows of fine punctures, the juxta-sutural row changing to a fine stria behind. The raised lines of the prosternum are long and convergent, almost meeting in front, and the metasternum bears only a very few scattered punctures.

Length 3·5 mm.

Eastern New Guinea : Kokoda, 1200 ft. (*Miss L. E. Cheesman*, May).

Numerous specimens were found in fungi.

Like *S. cyanecula* Crotch, this exhibits the peculiarity of a pale head and legs contrasted with dark pronotum and elytra. It is a rather smaller and distinctly more narrowly oval insect than that or *S. antennalis* and the elytra, though more metallic, are of a less lively colour. The antennae and legs are a little more slender and the antennal club is a little narrower.

In conclusion I append a key to the species of *Spondotriplax*, omitting only *S. flavofasciata* Araki, the description of which is not accessible, and a list of the species, 18 in all, of which only three are included in the genus in the catalogue of Erotylidae by Kuhnt (W. Junk, 1911).

1(20). Elytra spotted or banded . . . . . (Indo-malayan spp.).
2 (5). Body red with black spots.
3 (4). Elytra with two black spots . . . . . *quadrimaculata* Kirsch.
4 (3). Elytra with more than two black spots . . . . *andamana* Arrow.
5 (2). Not red with black spots.
6 (9). Shoulders of the elytra black.
7 (8). Antennal joint 3 shorter that 4 and 5 together . . *amabilis* Heller.
8 (7). Antennal joint 3 longer than 4 and 5 together . . *diaperina* Gorham.
9 (6). Shoulders of elytra not black.
10(11). Elytra with four large red or yellow spots . . . . *exquisita* Arrow.
11(10). Elytra not four-spotted.
12(17). Head dark.
13(14). Pronotum very feebly punctured . . . . . *javana* Arrow.
14(13). Pronotum distinctly punctured.
15(16). Post-median pale band narrow . . . . . *soror* Arrow.
16(15). Post-median pale band broad . . . . . *monticola* Heller.
17(12). Head pale.
18(19). Anterior and posterior pale elytral marks converging . *fulviceps* Arrow.
19(18). Anterior and posterior pale elytral marks far apart *pallidipes* Arrow.
20 (1). Elytra not spotted or banded (Papuan species).

21(24). Head dark.
22(23). Elytra very lightly punctured . . . . . *antennalis* sp. n.
23(22). Elytra strongly punctured . . . . . *cyaneipennis* Wat.
24(21). Head pale.
25(26). Elytra with pale extremities . . . . . *jucunda* Mader.
26(25). Elytra without pale extremities.
27(30). Pronotum pale.
28(29). Elytra black (brown, red or yellow when immature) . . *laratina* Arrow.
29(28). Elytra green or blue . . . . . *ceramensis* Crotch.
30(27). Pronotum dark.
31(32). Broadly oval : elytra blue or green . . . . . *cyanecula* Crotch.
32(31). Narrowly oval : pronotum and elytra steely-black . . *metallica* sp. n.

List of the species of *Spondotriplax* Crotch.

syn. *Neotritoma* Heller, 1920, *Arch. f. Nat.* **84** (A) : 41.
Rhopalotritoma id., op. cit. : 27.

amabilis Heller (*Rhopalotritoma*), *op. cit.* : 41.
andamana Arrow, 1925, *Fauna of India, Erotylidae, etc.* : 144.
antennalis sp. n.
ceramensis Crotch, 1876, *Cistula Ent.* **1** : 469.
cyanecula Crotch, *loc. cit.*
reibenspiesi Mader, 1936, *Ent. Runds.* **54** : 113.
cyaneipennis Wat. (*Aulacochilus*), 1894, *Ann. Mag. nat. Hist.* (6) **13** : 71.
diaperina Gorh. (*Cyrtotriplax*), 1896, *Ann. Mus. Civ. Gen.* **36** : 290.
exquisita Arrow, 1926, *Ent. Mitt.* **15** : 260.
var. *propinqua* Arrow, *op. cit.* : 356.
flavofasciata Araki, 1941, *Trans. Kansai Ent. Soc.* **11** : 56.
fulviceps Arrow, 1925, *Fauna of India, Erotylidae, etc.* : 144.
javana Arrow (*Neotritoma*), 1923, *Treubia* **3** : 273.
jucunda Mader, 1936, *Ent. Runds.* **54** : 113.
laratina Arrow, 1926, *Ent. Mitt.* **15** : 356.
metallica sp. n.
monticola Heller (*Neotritoma*), 1920, *Arch. f. Nat.* **84** (A) : 45.
pallidipes Arrow, 1928, *Faune des Colonies françaises, Coleopt. Erotyl* : 341.
quadrimaculata Kirsch (*Cyrtomorphus*), 1875, *Mitt. Zool. Mus. Dresden* **1** : 57.
endomychoides Crotch, 1876, *Cistula Ent.* **1** : 469.
soror Arrow, 1925, *Fauna of India, Erotylidae, etc.* : 143.

The types of the four new species described are all in the British Museum (Natural History).

THE SIGNIFICANCE OF VESTIGIAL OBLIQUE VEINS IN THE EVOLUTION OF INTERCALATED VEINS IN THE ODONATE WING, WITH THE DESCRIPTION OF A NEW GENUS

By Lt.-Col. F. C. Fraser, I.M.S. Retd., F.R.E.S.

Whilst examining under the microscope the minor details of venation in the wings of a *Lestes sponsa* Hansem, I was interested to notice in one of the wings that the intercalated vein IRiii was disconnected at its base. Instead of joining Rii + iii as is usual in the Lestine venation, it ended blindly in the membrane extending between that vein and Riv + v, very much in the same way as do many intercalated veins in the Ephemeridae. I naturally mistook this unusual formation to be a defect in the venation, but when a large number of wings had been examined I found that a similar break in the vein was present in 5 per cent. It was obvious that such a high percentage entirely ruled out any possibility of accidental defects and that some other reason for this formation must be looked for.

Needham holds that the vein IRiii is a composite one, its distal half representing the distal end of Rs and its inner a secondary " bridge-vein " which has been formed backwards from Rs to the base of the wing in order to strengthen the venation in this part. He has explained how, in the Lestinae, the Radial sector after passing along Riii, crosses over to IRiii by the medium of an oblique vein and thereafter runs to the periphery of the wing. In the larval wing this is certainly true, for the trachea may be seen clearly taking such a course, but whether the trachea preceded the vein originally, or the vein the trachea, is still a matter for argument. The oblique vein, occupying approximately the same place, is invariably present in the wings of the Lestidae and is recognised by all systematists as a family character. According to Needham then, the distal end of IRiii was formed from the level of this oblique vein towards the periphery of the wing, whilst the proximal part of the intercalary was laid down in the opposite direction, viz., from the oblique vein towards the base of the wing. The failure of IRiii to make contact with the basal veins in some 5 per cent. of the wings clearly implies that Needham was correct in, at least,the latter half of his theory relating to the formation of the " bridge-vein."

Tillyard (1922, *Ent. News* **33** : 7), in discussing the formation of IRiii in the Lestidae, says : " It is certainly possible to prove from the fossil record that Needham's supposed bridge-vein was never formed backwards as a bridge-vein but was always the basal portion of a strongly formed main longitudinal vein arising from Riv + v or sometimes from Rii + iii as in most recent forms."

Now if IRiii were all that Tillyard claims it to be from fossil times, it is certain that its organisation would be fully crystallised and that it would originate from a constant source : Tillyard gives it two alternatives. I have made an analysis of the various endings of this vein in *Lestes* and find them to be as follows :—Attached to Rii + iii, 70%; to Riv + v, 11%; to the angle formed between these two same veins, 13%; by a dichotomy of its end to these two veins, 1%; and not attached to any veins, 5%. This evidence, then, goes to show that although there is a marked tendency for IRiii to establish a connection with Rii + iii (not to Riv + v as stated by Tillyard), this is by no

means constant, and the variability of the connections taken together with the failure, in some wings, of any connection to be established at all is hardly what one would expect to find in an organ claimed to have been established from fossil times, and, in my opinion, is sufficient proof that IRiii never originated from a basal source but extended inwards from a peripheral one : whether this was from the neighbourhood of the Lestine oblique vein or from the border of the wing still remains to be proved.

There are several " oblique cross-veins " in the wings of the Odonata, which are so constant in their occurrence and position as to have come to be regarded as either ordinal, familial or generic characters. Each of these, from its fixity, must have served or may still serve some important function in the stability of the wing, otherwise it would never have been preserved. In addition to the " Lestine oblique vein," the most important are : (1) a basal one known as the Anal-crossing (Ac), which served and still serves as a pathway

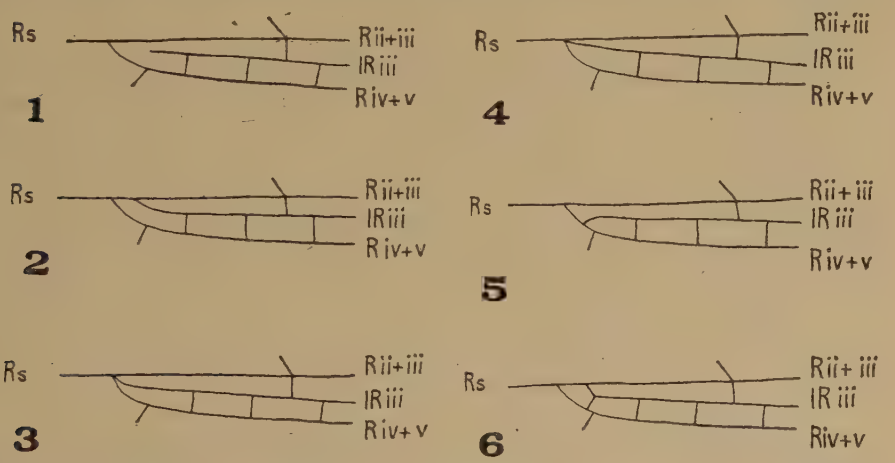

FIG. 1.—Variation in the attachment of the vein IRiii as seen in : 1. *Lestes dryas* Kirby; 2 to 6. *Lestes sponsa* Hans. Notation : Rs, Radial sector; Rii + iii, Riv + v branches of Radius; IRiii intercalated vein. (Tillyardian notation employed.)

for the Anal trachea to rejoin the distal portion of the Anal vein, and (2) a short oblique vein which extends from the postero-external or posterior angle of the discoidal cell to join the Anal vein. The first of these is too well known to require further description here; the second has not received the attention which it deserves. The Comstock–Needham venational theory describes the formation in this part of the wing as a bifurcation of the Cubitus into Cui and Cuii, the extreme base of the latter being the oblique vein now in question. Tillyard showed, however, by the fossil record, that the Anterior branch of the Cubitus has been lost in the Odonata : that the branch regarded by Needham as this vein is actually the Posterior branch (CuP) and that the supposed posterior branch of Needham (Cuii) is actually the Anal vein, which, having lost its basal connections, has been switched on to the Cubitus. The Anal vein, however, as I have shown (1938, *Proc. R. ent. Soc. Lond.* (A) **13** : 60–70) is continued basally in the Coenagrioidea beyond this point and ends by fusing with the posterior border of the wing; the apparent ending on CuP is actually an *oblique vein* connecting it to CuP and serves for the passage of a trachea from the latter to supply the distal portion of the Anal vein. Thus it will be seen that we have

here an exact parallel of the Lestine oblique-vein complex : this will be better appreciated in the following table which compares the respective and component parts of IRiii and the Anal vein :—

Distal portion of IRiii from the periphery of the wing to the level of the oblique vein connecting it with Riii.	Distal portion of the Anal vein from periphery of the wing to the oblique vein connecting it with CuP.
Oblique vein linking IRiii and Riii.	Oblique vein linking the Anal vein with CuP.
Lestine bridge-vein running from the level of oblique vein to Rii + iii (or to Riv + v).	Anal bridge-vein (Ac) linking the Anal vein with the posterior border of wing or to Ac.

The only difference to be noted between these two formations is that the Lestine bridge-vein is an original or primary one, whilst the Anal-bridge represents a reconstruction of the obsolete basal portion of the Anal vein and must therefore be regarded as of a secondary nature. The evolution, however, of the two formations may be shown to follow along exactly the same lines.

A study of the comparative anatomy of the intercalated veins throughout the Order Odonata serves to show how these veins originate in small beginnings at the periphery of the wing and gradually extend inwards until, ultimately, some of them, the most important for the stability of the wing, establish basal connections with one or other of the main primary veins. It also shows how they become *tracheated in sections*, at first near the middle of the wing, but ultimately from their basal connections. The medial tracheations are hall-marked for long periods and, perhaps for all time, by the presence of *oblique veins* which show where the tracheal supplies came into each completed section of the veins. An exhaustive review of the whole Order in this respect would take up too much space and would require too many text-figures, which for reasons of economy are impossible in these times, but the same result may be arrived at by selecting a few examples demonstrating the various stages in the evolution of the veins. I am most fortunate in this respect in having acquired from Dr. Schmidt, just prior to the outbreak of war, a meagre description but accompanied by a good wing photograph of a new genus and species of dragonfly very closely allied to the genus *Perilestes*, which latter stands right at the base of the family Lestidae.[1] With the aid of this wing, I am able to give an almost complete chain illustrating the evolution of intercalated veins and of IRiii in particular in all of its three stages. I am not aware that a description of this new genus has been published yet, but as it occupies an important position in this paper, I have given in an appendix a short description of such details of it as are known to me, together with a figure of the wings.

Comparative Anatomy of the Intercalated Veins IRii and IRiii.

IRii. The vein IRii is found in its most primitive form in the genus *Perilestes* and a progressive lengthening of the vein from the apex of the wing to as far basal as the level of the nodus is to be seen in a series of wings starting at this genus and ending up with the recent Agriidae.

In *Perilestes stultus* and *attenuatus* it is only 4 cells in length and ends proximally at the level of the outer or inner end of the pterostigma. In *Perissolestes remotus* it has doubled in length, is now some 8 cells long and extends into 3 cells proximal of the pterostigma. Thus even in the horizon of a single

[1] See page 65.

subfamily we find evidence of an intercalated vein lengthening inwards from the periphery of the wing. In *Eolestes*, *Chorismagrion* and many species of *Lestes* the vein has lengthened to a point half-way between the pterostigma and nodus and is 14 or more cells long. In *Synlestes* it ends on Rii at a point considerably nearer the nodus than pterostigma, and finally, in the AGRIIDAE, it may actually reach the level of the nodus. No tracheation of this vein has been so far observed in the larval wing of any species. The inner end bifurcates,

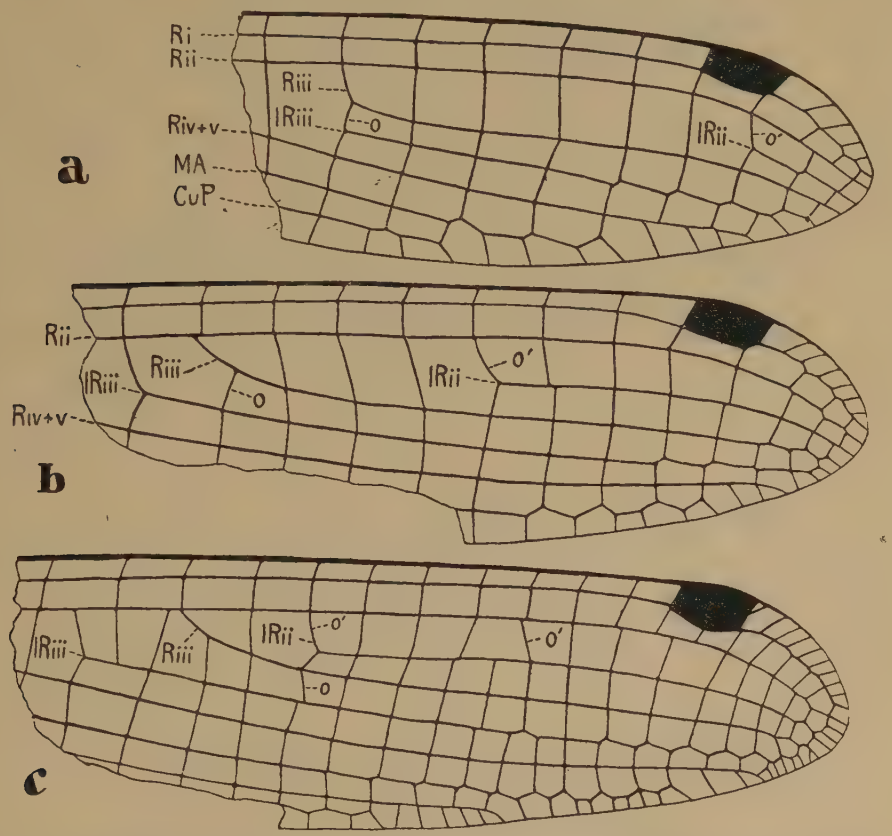

FIG. 2.—Development of the intercalated veins IRii and IRiii as seen in: a. *Perilestes solutus* Will.; b. *Perissolestes remotus* Will.; c. *Eolestes diotima* sp. n. (Schmidt MS.). Notation: Ri, Rii, Riii and Riv + v branches of Radius; IRii and IRiii intercalated veins; *O*, Lestine oblique vein; *O'*, oblique veins of IRii.

the anterior arm is nearly always the longest and joins Rii very obliquely as if it were tracheated from that vein. In *Philoganga* there are two or three oblique veins connecting Rii with IRii which are so constant in position and occurrence as to have come to be regarded as generic characters. These oblique veins suggest, in this genus, that IRii has developed in three sections, each oblique vein representing a former more primitive ending of the vein where a trachea from Rii grew into it. It is tracheation which " fixes " these oblique veins and I find it difficult to believe that unless the vein had established a permanent attachment to Rii or had become static over a long period, a tracheation would

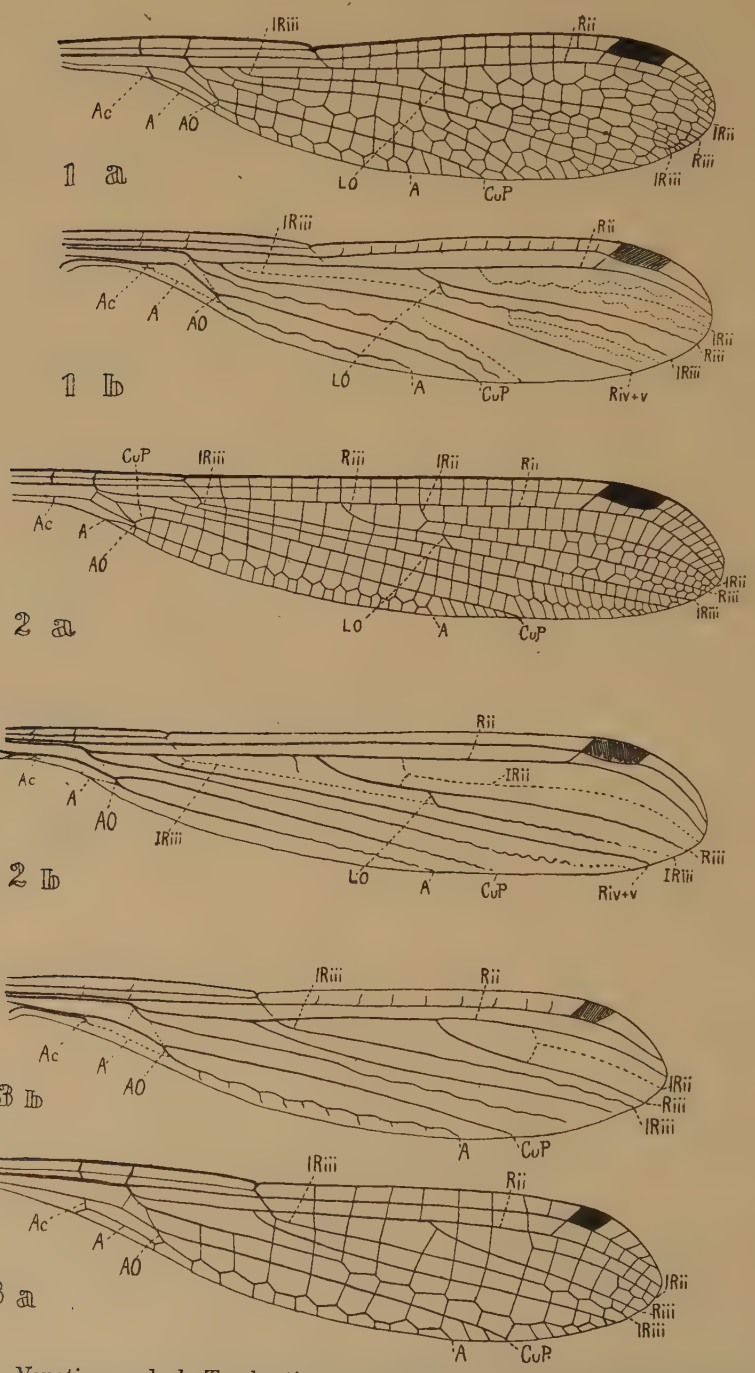

FIG. 3.—*a*. Venation and, *b*. Tracheation contrasted in: 1. *Lestes sponsa* Hans.; 2. *Synlestes weyersi* Selys; 3. *Coenagrion dyeri* Fraser. Notation: IRii, IRiii, intercalated veins; A, Anal vein; Ac, Anal tracheal crossing; AO, Anal oblique vein connecting A and CuP; LO, Lestine oblique vein; Rii, Riii and Riv + v, branches of Radius; CuP, posterior branch of Cubitus.

be possible. Roving veins are no more likely to gather tracheae than rolling stones are to gather moss.

IRiii. The evolution of the vein IRiii is somewhat similar to that of IRii, but in no species of Odonata is it found to be as primitive as the latter is in the genus *Perilestes*. It extends, however, for a greater distance into the wing and there is definite evidence that a sectional development such as I have suggested may have occurred in the case of IRii in *Philoganga*.

In the genus *Perilestes* the species *solutus* and *attenuatus* have the vein of the same length as Riii, whilst in *Perissolestes remotus* it extends for 1 or 2 cells beyond that vein : its end is oblique and, in addition, there is frequently a more

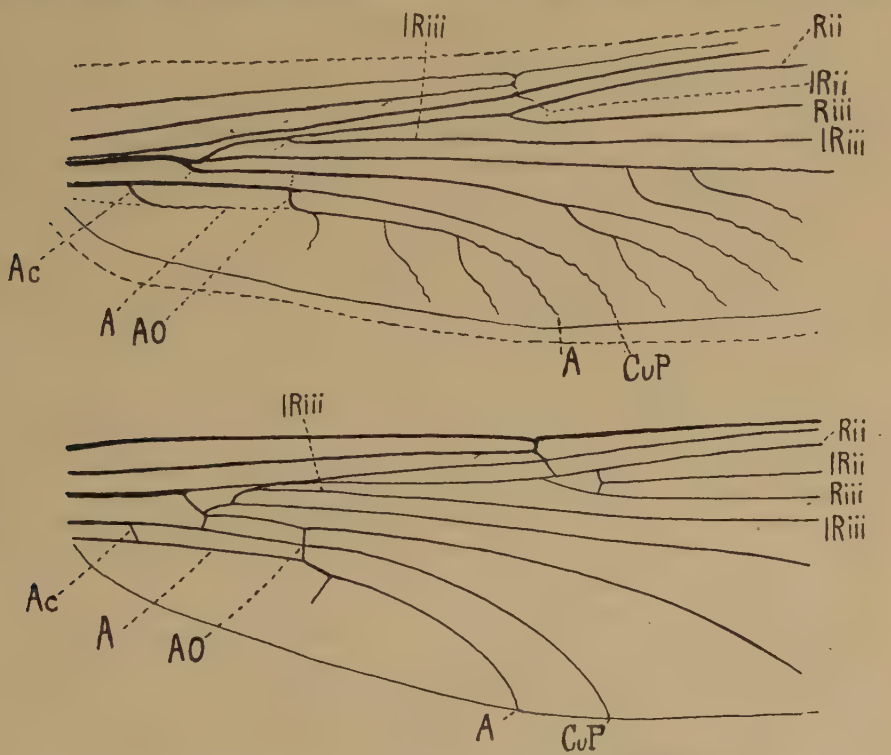

Fig. 4.—Venation and tracheation of *Agrion* sp. contrasted. Notation as for fig. 3.

distal oblique vein present connecting it to Riii which may represent the pathway of a trachea. In the former two species, however, no oblique vein can be said to be constantly present.

In the genera *Eolestes*, *Chorismagrion* and *Heteragrion* a considerable lengthening of IRiii is seen, the vein now overlapping Riii by at least 3 cells : in the first of these genera, an oblique vein is present at the same site as the Lestine one, and evidently represents a tracheation from Riii at that point. In *Synlestes* the vein is attached to Riv + v or Rii + iii at the subnodus : it has greatly lengthened and its formation is exactly similar to what is found throughout the Coenagriidae, except that an oblique vein is present (but occasionally absent) connecting it to Riii similar to the Lestid condition. With such a formation present, it might be thought that the tracheation would

be similar to that found in the Coenagriidae, so that it becomes a matter for surprise to find that the tracheation resembles that of the *Lestes*. Thus although the venation has advanced to that of the Coenagriidae, the tracheation still remains in the primitive Lestine condition. I can only infer that this represents a transitional condition and that until a new and more proximal tracheation takes place from the level of the subnodus the Lestine oblique vein will persist. Conversely, as a new tracheation has developed at the level of the subnodus in the Coenagriidae, the distal oblique vein has become obsolete in them, which fact again goes to prove that tracheation of a vein only occurs when it has become static over a long period. It is interesting to reflect on what is going to happen in the case of the *Synlestes*. Will the vein IRiii continue lengthening beyond the subnodus as in the *Lestes*? Or will it acquire a new trachea and become fixed at the subnodus as in the case of the Coenagriidae? There is, of course, an alternative explanation, viz., that the vein IRiii has evolved on different lines in the Coenagriidae, and that instead of halting distally it has pursued a steady and uninterrupted course from the periphery of the wing until it attained to the level of the subnodus. Tracheation would

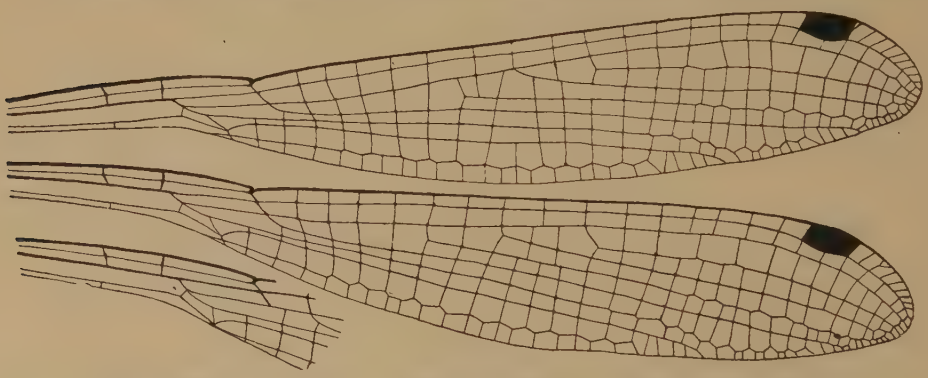

Fig. 5.—Wings of *Eolestes diotima* sp. n. (Schmidt MS.). Inset, Base of wing of *Perilestes* sp.

never occur until the vein became static at the subnodus and there would be no oblique veins marking out its course. If this latter be the correct explanation, then the Lestidae and Coenagriidae must have pursued two widely diverging lines of evolution, the former branching off from the latter in Permian or Carboniferous times.

In the *Lestes*, IRiii makes a great advance and, carrying on past the level of the subnodus, becomes attached to one of the main veins quite near to the arculus. As already stated, this attachment is yet in a very indeterminate condition, its ending being either on Riv + v or Rii + iii or absent altogether. An oblique vein passing between Riii and IRiii is invariably present near the centre of the wing and represents the path by which a trachea passes from Riii to supply the distal end of the vein: the proximal portion is never tracheated and there is no oblique vein at the subnodus (as in the case of *Synlestes*) to suggest that the vein has halted for any time at that level.

Kennedy (1920) has advanced an interesting theory to account for the "oblique vein" in the Lestidae. He suggests that the position and length of IRiii in the Perilestinae represent the archaic condition of the Lestidae, and that when the wing began to broaden in the course of evolution the forkings of the main veins retreated towards the base of the wing, whilst IRiii lagged

behind and so was bypassed by the others. It is the inner end of this vein, as it now stands in the PERILESTINAE, which persists as an oblique vein in the LESTIDAE. Unfortunately he regards the vein IRiii as an integral part of the Radial sector (Rs), viz., as the posterior branch of the forking of that sector instead of a pure intercalated vein, and so has missed the significance of his inspiration. If IRiii be regarded as an intercalated vein, Kennedy's theory at once becomes more attractive, as it explains why the vein did not follow the others in their recession towards the base of the wing, because in the one case it was the origins of veins which were involved, whilst in the other it was endings. The shifting of the origins of the main veins merely involved some minor adjustments at the points from which they branched off, whereas the vein IRiii would have had to undergo an actual lengthening to attain to a similar result. The main longitudinal veins are anchored to and controlled from the base of the wing : intercalaries are anchored to and controlled from the wing's periphery : it is as if, in the changing relativity of the structures of the wing, the two groups of veins were pulled in opposite directions.

The Lestine formation of IRiii shows but little change in the Anisoptera but the proximal non-tracheated portion is considerably shorter. Tillyard (1922) has already shown how this shortening has been brought about by the acquisition of a new tracheation in the neighbourhood of the subnodus, as demonstrated in the family PETALURIDAE. In these archaic forms there are two oblique veins present, the original one in its Lestine position and a second more proximal one. In their larval tracheation we see a transitional stage from the Lestine to the Anisopterine : there are two tracheal twigs connecting Riii with IRiii, and it is evident that in the rest of the Anisoptera it is the most proximal one of these that has replaced the distal one, the latter having become obsolete from disuse.

The final stage in the evolution of the intercalary IRiii is reached as a natural sequence in the higher forms of the suborder Zygoptera. In them it has extended almost right up to the arculus and after acquiring an attachment to Rii + iii has become tracheated from that level throughout the whole of its length. As in the case of the Coenagrioidea and the Anisoptera, the acquiring of a more proximal tracheal supply has resulted in the disappearance of the oblique veins which indicated the source of previous tracheations : all suggestions of a " bridge-vein " have been lost and the vein has taken on all the characters of a main longitudinal vein, which Tillyard thought it actually to be. This perfecting of IRiii in the higher forms of the Agrioidea is unique and taken together with the alignment of the secondary, and the disappearance of the primary antenodals, represents the highest stage of development yet attained to in the Order Odonata.

The importance of the evidence in the phylogeny of the Order afforded by a study of the evolution of the vein IRiii must be stressed. It points to a direct descent of both the higher Zygoptera and the Anisoptera from a Lestine ancestor and thus adds to the evidence that already suggests such an origin.

APPENDIX.

Eolestes gen. n. (Schmidt MSS.).

A genus of small slender Lestine dragonflies with facies rather closely resembling that of *Perilestes*. Wings somewhat broader than in this latter genus and reticulation much closer. Discoidal cell separated from the posterior border of wing by the breadth of

subdiscoidal cell, very long and narrow, very acute at distal angle, costal border about four times as long as the basal, about half the length of posterior side in fore-wing, and quite three-fifths the length of posterior side in the hind-wing: Ac at the level of the proximal antenodal, Ab nearly obsolete, the Anal vein fusing with the posterior border of wing just beyond the middle of the discoidal cell: CuP curving strongly forwards immediately after leaving apex of discoidal cell: arculus well distal of the distal antenodal: Riv + v arising at the subnodus, IRiii attached to Rii + iii at the level of the 6th postnodal, Riii arising 2 cells distal to this and IRii 2 cells beyond Riii. Pterostigma short and stout, egg-shaped but with inner and outer ends very slightly oblique, covering 2 cells: 15 to 16 postnodals. Nearly the whole of the cells in the wing quadrate: the wings markedly falcate at apex and closely resembling those of the PLATYSTICTIDAE in this respect. Petiole very long and slender as in genus *Perilestes*.

Genotype: *Eolestes diotima* Schmidt MSS.

Eolestes diotima sp. n. (Schmidt MSS.).

Habitat: W. AFRICA: Cameroons. Details as for the genus. The genus appears to stand midway between *Perilestes* and *Chorismagrion*, differing from the former by the more proximal ending of the veins Riv + v and IRiii and by the discoidal cell not resting on the posterior border of the wing: from *Chorismagrion* it differs by having the discoidal cell of the fore-wings closed (the base of this cell missing in *Chorismagrion*) and by its longer and narrower wings. The position of the veins Riv + v and IRiii are similar to those of this latter genus. As is usual in archaic genera, these three are widely scattered, *Perilestes* coming from S. America, *Chorismagrion* from Australia and *Eolestes* from Africa: they must be regarded as surviving remnants of a once widely distributed fauna.

Type material presumed to be in the possession of Dr. Schmidt: see page 60.

SUMMARY.

In this paper it is shown that the longitudinal veins of the wing fall into two categories: (1) the primary main veins which arise from the base of the wing and are tracheated directly from the central system, and (2) the intercalated veins which arise from the periphery of the wing and extend inwards to become secondarily tracheated by branches given off from the primaries. The sites of these tracheations are indicated by "oblique cross veins" which tend to persist as vestigial structures in the venation. The evolution of the intercalary IRiii is traced from near its genesis as a short non-tracheated vein in the archaic PERILESTINAE to its final consummation as a fully tracheated vein in the higher forms of the Agrioidea, in which it takes on all the characters of a main basal longitudinal vein. Intercalaries are shown to develop in sections, each of which is limited proximally by an oblique cross vein and each of which is tracheated in turn, a proximal tracheation replacing the one immediately preceding it. Transitional forms are found in which two tracheae and two oblique veins, the new alongside the old, persist. Finally a short description of a new genus is given in an appendix to the paper.

The Tillyardian notation is used throughout this paper.

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Book Notice.

The genus *Conotrachelus* Dejean (Coleoptera, Curculionidae) in the North Central United States. By H. F. Schoof (*Illinois biol. Monogr.* **19** (3)). 1942. pp. 1–170, illust.

This work was primarily written as a thesis for the degree of doctor in the University of Illinois, but it has since been revised and augmented.

The genus *Conotrachelus* embraces 930 known species, the majority of which occur in South and Central America, and a few in the United States and Canada.

The work aims to produce workable keys and descriptions of the species from Illinois, Wisconsin, Iowa, Missouri, Kentucky and Indiana; to study the morphology of the male genitalia and determine the taxonomic significance; and finally to evaluate the morphological characters previously used in the classification of the genus, and, if possible, indicate additional characters.

The present classification arranges the species dealt with in four groups, and six new species are described, of which one occurs outside the area. A list of literature is given, and 109 figures of genitalia are shown on 9 plates.

Book Notice.

A preliminary revision of *Hesperia*. By A. W. Lindsey. (*Denison Univ. Bull.* **42** (= *J. sci. Labs. Denison Univ.* **37**) 1942.)

In 1919 a paper on the Hesperioidea of America north of Mexico appeared, and this was revised in 1930 and brought up to date.

So far, however, a satisfactory classification of *Hesperia* has not been published, and it was to fill the need of this that the author started the work which has produced the present preliminary paper.

The outbreak of war is largely responsible for the lack of finality, but the lack of means to produce the requisite coloured illustrations is also regretted by the author.

After a full description of the genus, a key which extends to 74 couplets is given, followed by a full description of the 28 included species.

The illustrations show the genitalia of each species, and a photograph of the upper and under sides is also given.

PUBLICATIONS

The Publications of the Royal Entomological Society are *Transactions* and *Proceedings*.

The *Transactions* form an annual volume, each paper in the volume being issued as a separate part. The parts are issued irregularly throughout the year.

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Smith, A., 1936, New species of Coccidae. *Proc. R. ent. Soc. Lond.* (B) **6** : 301–306, pl. 1.

——. 1936, New species of Coccidae. *Trans. R. ent. Soc. Lond.* **84** : 901–936.

Titles of periodicals cited are to be abbreviated in the manner indicated in the *World List of Scientific Periodicals, 2nd edition*, 1934.

Authors are entitled to receive 25 copies of their papers free of charge and may purchase additional copies provided that request be made before publication.

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As from January 1936 the journal *Stylops* is continued as *Proceedings Series B. Taxonomy*. Copies of volumes 1–4 are available at *£1 16s. od.* each, post free.

MEETINGS

TO BE HELD IN THE SOCIETY'S ROOMS

41, Queen's Gate, S.W.7

1944.

WEDNESDAY, October 4
„ November 1
„ December 6

1945.

WEDNESDAY, January 17 (ANNUAL MEETING)
„ February 7

THE ROYAL ENTOMOLOGICAL SOCIETY OF LONDON

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